superior varieties of rice and cotton, can only be grown on good soil; on poor soil they at once deteriorate. The same may be said of live stock: the miserable native breeds are accustomed to starve during a part of every year; such treatment would be fatal to better animals. Until good fodder crops are grown, any permanent improvement in the breeds of farm animals is impracticable.

We might easily extend our notice of this useful volume; it is full of practical information, and must prove of great value to all engaged in agricultural operations in India.

R. W.

Grundriss der chemischen Technologie. Von Dr. Jul. Post. Part ii. (Berlin: Robert Oppenheim, 1879.)

We have already noticed the first part of Dr. Post's excellent manual of chemical technology (see vol. xvi., 83), which made its appearance towards the end of 1876. Unfortunately, the completion of the work has been delayed by the severe and prolonged illness of the editor. The first portion was mainly confined to a description of the modes of manufacture of crude or intermediate products; the second part treats of the finished or final products. Objections might, doubtless, be raised against such a mode of treatment, but we question if, on the whole, a more systematic method of dealing with so complex a subject as chemical technology could have been devised. The entire work forms unquestionably one of the most, if not *the* most, complete repertorium of the existing processes of industrial chemistry that we know of in any language, and as such we can confidently recommend it to the notice of our chemical manufacturers. Dr. Post has been assisted by an excellent band of collaborators, many of whom are recognised as authorities on the subject of their respective communications. A due amount of space is usually devoted to a consideration of the theory of the various processes when this has been at all worked out; and the description of the mode in which these processes are actually carried into operation is facilitated by numerous diagrams and plans. Dr. Post is to be congratulated on the completion of an exceedingly useful work.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

The November Meteors

The cloudless sky from the morning of the 12th to the 15th, with the total absence of moonlight, afforded a most favourable opportunity for the observation of the meteors of the Lion. A constant watch was kept up at this observatory from 10 P.M. until daybreak of the 13th, 14th, and 15th, and the results show that the Leonids were considerably in excess of what they had been during the last few years.

The total number of meteors observed was 309, and out of these 104 radiated from the Lions, and 56 clearly indicated five principal radiant points. Four of the radiants were situated near the stars ϵ, γ, δ, and η Leonis, and the fifth was just below (31) Leonis Minoris. The position of this east point was very clearly marked by a stationary meteor of the 1st magnitude. Eighty-six of the meteors were of the 1st or 2nd magnitude, and nine others were brighter than 1st magnitude stars. The largest number of Leonids seen during a single hour was fifteen, from 4 to 5 A.M., on the 14th.

S. J. Perry

Stonyhurst Observatory, November 18

The Platysomid Fishes

I am very sorry to find that my esteemed friend Prof. H. Alleyne Nicholson has, in the new edition of his "Manual of Palæontology" (vol. ii. p. 138, *note*) committed the mistake of quoting me as his authority for elevating the Platysomid fishes to the "rank of a distinct division of Ganoids." No such proposition occurs in the unpublished paper to which he refers, which was written to follow up the views which I expressed in my account of the structure of the Palæoniscidæ (Palæontographical Society, 1877), as to the abolition of the sub order "Lepidopleuridæ," necessitated by the demonstration of the fact that the Platysomidæ as a *family* are not really allied to the Pycnodontidæ, but are on the other hand so closely linked by ties of structure to the Palæoniscidæ, that, wherever the latter family is placed, thither the Platysomidæ must follow.

My paper on the "Structure and Affinities of the Platysomidæ" was read before the Royal Society of Edinburgh on May 5 of this year, and will in a few weeks appear in the forthcoming fasciculus of that Society's *Transactions*. Prof. Nicholson's mistake as to my views is obviously due to his having only had, and that on one single occasion, a very hurried glance over my proof-sheets.

R. H. Traquair

8, Dean Park Crescent, Edinburgh, November 12

Voice in Fish

The question as to whether fish have any so-called voice or means of intercommunication having some interest for your readers, I may relate that about six years ago, while engaged in a survey of the Disang River in Eastern Asam, I had occasion to sound by a line the depth of a pool called the "Deo Dubé" (or deep of the Demon).

While seated in a small *Rob Roy* canoe and very slowly drifting on the pool, I became aware of a number of large Mahsir (*Barbes macrocephalus*) moving about in the water below and around me. Sitting perfectly still I had the pleasure to see them gradually approach the surface and move about me at a foot or so distant, passing alongside, under and round the canoe carefully examining it, bow and stern specially. It may not be easy to guess a fish's *thoughts*, but from the manner in which they examined my symmetrical and grey coloured canoe they appeared to think it might possibly be a huge fish, and dead of course.

While watching their movements I was aware of a peculiar "cluck," or percussive sound—frequently repeated, on all sides, and coming from below, but close to me. Eventually I found that this was made by the Mahsir, and one—passing close along on my right, by itself, made several *distinct* sounds as it went on—that seemed answered by others to the left. If seated, say on the bank, the sound would be loud enough to be heard at 40 feet distance.

A large bivalve also is common in some parts of Eastern Asam that sings loudly in concert. A small *ant* also makes a peculiar thrice-repeated noise by scraping in unison on the dry leaves of its nest if it is disturbed.

S. E. Peal

Silurian Fossils in the "Lower Old Red Sandstone" of the Curlew Mountain District

Your correspondent in Nature, vol. xxi. p. 32, on the above subject has evidently misunderstood the notice (Nature, vol. xx. p. 641). The rocks in question, though belonging to what is generally known as the "Old Red Sandstone," contain Silurian fossils, which confirms the opinion of myself and others that the lower Old Red should be regarded as the upper part of the Silurian formation.

G. Henry Kinahan,
President of the Royal Geological Society of Ireland

Dublin, November 17

The Paces of the Horse

A good many ingenious contrivances have lately been invented by which to find out the true movements of the feet of the horse in its various paces, notably that described in "A Study on Locomotion" which appeared in Nature, vol. xx. pp. 434, 468, 488.

My object in writing this letter is to challenge the assumption of all these experimenters that their diagrams should constrain artists to correct their representations of animals in motion.

When, for instance, Prof. Marey says of his diagrams, "these pictures are correct as regards the position of the members; it would be the artist's duty to add elegance of form," it is apparent to me that such a division of labour would never produce a picture. Take Fig. 16, for instance, representing the true position of the legs in galloping, and I venture to say no amount of

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elegance added would convey an idea of what the animal was doing.

I submit that the error which leads the experimenters so far is forgetting that the mechanism of the human eye has as much to do with the matter as the movements of the horse's feet.

Confining my argument to the gallop, I contend that the conventional extended attitude is true artistically, though it never actually takes place whilst the horse is at this pace. The eye (as is sufficiently proved by the need of machinery for finding out the actual motions of horses' feet) does not obliterate and receive impressions sufficiently quickly to trace the three paces in the gallop; but it can note the fact that at some moment during each bound, each of the four reach this extreme point. Now the feet are twice as long at this point as at any other, that is to say, the passing out over and returning along the last inch is for the eye a pause at the extreme. It is no more doubtful that a galloping horse should be painted as it usually is, than that a swinging pendulum can only be suggested by drawing it at one or other extreme of its excursion. An artist could no more use Prof. Marey's diagrams in the way it is assumed he should, than he could represent a rolling wheel if he took no liberties with the apparent position of the spokes; but confined himself by remembering their true places and numbers, which of course are the same as when the wheel is at rest.

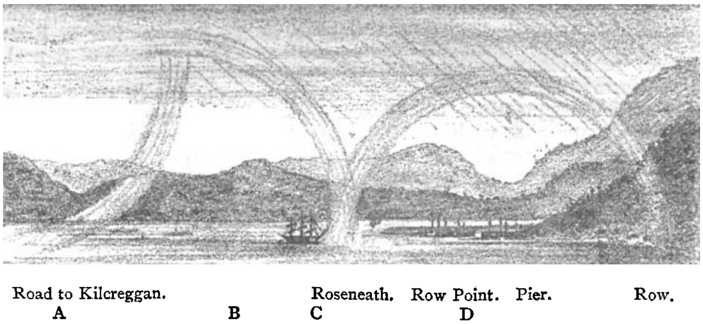
It is true that a galloping horse might also be represented with all its legs gathered under it, but this is not done, because, as I agree with Prof. Marey, "it is the artist's duty to add elegance of form;" whilst I dissent from him when he allows himself to be convinced that "the greater part of the horses [of Phidias] are represented in false attitudes" because the odograph says so.

W. G. Simpson

Edinburgh, November 12

A Curious Rainbow

I send you a rough sketch of a curious rainbow group seen in Gareloch about 8.25 A.M. on October 20. I would have written sooner but I delayed till I had obtained sketches from several different sources. I only saw the junction of the two bows at C, that being the only part of Row Bay visible from my standpoint, but several observers saw the whole group as I have drawn it. The sea was quite glassy, so that the inverted rainbow A must have been formed by the sun's rays reflected from the water. The wind was just beginning to rise and some scudding showers were passing up from the Firth of Clyde from the south-west, but the bay was quite calm. The bow D was perfectly full and bright, while B died away at its highest point. I can only imagine that B was formed by light reflected by some bright cloud, but I did not observe any bright enough. The view is nearly north-west. As I have never even among our Scottish hills seen such a combination of rainbows, I think the description may have some interest for some of your readers. The hill to the right is Knapps Hill, and is 2,000 feet high and three and a half or four miles distant.



J. B. Hannay

Woodbourne House, Helensburgh, November 4

How Snakes shed the Skin

In Nature, vol. xx. p. 530, Dr. H. F. Hutchinson, amid some interesting facts about snakes, says: "I have never witnessed the process of skin-shedding, nor, I believe, has any observer." The Doctor then ventures an ingenious, though incorrect, hypothesis of his own. In the *American Naturalist* for January, 1875, *i.e.*, vol. ix. No. 1, under the title, "The Pine Snake of New Jersey," I gave an article embodying the results of several years' study of *Pituophis melanoleucus*, in which the process of exuviation is described as witnessed by myself. Herewith is an abstract. The few words interpolated for the sake of clearer exposition are put in brackets.

Near the close of September, 1873, at 1 P.M., looking into the box, I saw that the female snake had started the skin from her head. It was a little torn at the snout, and I found that the head and a little of the neck were denuded. The denuding process was going on, but very slowly. Doubtless the chief difficulty was in starting the skin, and I felt sorry that I did not see the start. The neck was very slowly becoming divested of the old cuticle, which, at first glance, had a sort of back-creeping aspect. What surprised me was the fact that there was not the least friction in the process; that is, there was no rubbing against any exterior object. It really did look as if an invisible power was drawing the skin back upon itself. [Looking closely, I caught the secret. There was a systematic alternate swelling of the body at the neck of the skin, thus stretching it, and making a shoulder in front of the neck, each swelling pushing the loosened skin a little backward.] The old skin at this time is very moist and soft, and any swelling of the body stretches and loosens it. So soon as the exuviation has reached the part of the body containing the larger ribs, this doffing of the old suit proceeds more rapidly, and with a singular system. It is done just in this way: Exactly at the place where the skin seems to be moving backward, a pair of ribs expands. This action enlarges or puffs out the body, and by stretching loosens the skin at that place. In this movement both ribs in the pair act at the same time, just as the two blades of the scissors open together. Now comes a second movement of this pair of ribs, in which action the two ribs alternate with each other. One of them—say the one on the right side—is pushed forward and made to slip out of and in front of the constriction made by the swelling, when it immediately works backward, that is, against the neck of the double receding skin. Now the left rib makes a like advance, and in a similar manner presses backward. [Thus for every increment of exuviation, or backward movement of the inverting skin, three actions occur with rhythmic method; the expanding of one pair of ribs, the intumescence of the body at that spot, and the pushing back of the skin by the alternate action of each rib.] Thus the final action of each pair of ribs is not synchronous, but alternate, and has a notable sameness of movement and result with that of the alternate hitching of each side of the mouth when swallowing a large prey. Indeed, swallowing, with a serpent, is a misnomer, for that laborious hitching is not more a pushing of the prey down the gullet than a drawing of the body over it. The Western man said he always felt better after getting himself round a good beef-steak. With the serpent this is a literal fact; it puts itself outside of its victim. So with that singular costal action it seems to push the skin backward; but this is an illusion, for it actually pushes itself forward, pulling the skin out as itself advances out of the skin, thus with each movement or advance lengthening the inverted cuticle behind; that is, the old hose everts or evolves itself forward, though it appears as if by some occult force to be pulled on itself backward.

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